



**ELEVATE**

Equity through climate action

# Community Perspectives: Extreme Heat Challenges and Solutions in Chicago, Illinois

**DECEMBER 10, 2024**

## **NOTICE**

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# Background

The National Renewable Energy Laboratory ([NREL](#)) is a national laboratory owned by the U.S. Department of Energy ([DOE](#)). NREL is the only federal laboratory dedicated to research, development, commercialization, and deployment of renewable energy and energy efficiency technologies. NREL is managed and operated for DOE's Office of Energy Efficiency and Renewable Energy by The Alliance for Sustainable Energy ([Alliance](#)), the "M&O Contractor".

Elevate is a nonprofit organization with a mission to make affordable and clean heat, cooling, power, and water accessible to all homes and communities. Based in Chicago and working nationally, Elevate designs and implements clean energy, water, and workforce programs.

Extreme heat is the leading cause of weather-related death in the United States, and exposure to extreme temperatures is a growing public health concern as temperature and humidity increase globally.<sup>1</sup> Heat waves in Chicago are projected to become more frequent, intense, and prolonged.<sup>2</sup> In August 2023, a heat index of 120°F was recorded which was the highest heat index ever observed at Chicago's official climate observation site.<sup>3</sup> The use of mechanical cooling like central air conditioning (AC) protects people against heat-related morbidity and mortality, but access to AC varies across geography and demographics. Chicago lags behind the rest of the country with access to housing that has central cooling. Seventy-seven percent (77%) of Chicago households lack AC; only 30% of single-family homes have central cooling systems compared to 76% of single-family homes nationally. Chicago's 2- to 4-unit multifamily buildings are even less likely to have a central cooling system, with a prevalence of only 9%.<sup>4</sup> Increasing access to air conditioning is a critical need for Chicago, and the City of Chicago and Elevate have residential building decarbonization programs and \$21M in funding in place to provide heat pump air conditioning to residents who earn up to 80% of area median income (AMI).

In summer 2023, Elevate partnered with the Illinois Institute of Technology (Illinois Tech) to monitor indoor temperature and humidity in 10 Chicago homes without central AC. This research focused on the five most prevalent housing types in Chicago, representing over 333,000 homes citywide (over 75% of the city's residential building stock), allowing for a better understanding of how these building types perform during extreme heat events. We also collected data about participants' experiences with extreme heat, risk perception, and strategies to cope with extreme indoor heat. The results of that study pointed to a need for community risk assessment and a better understanding of the impacts of the building envelope on indoor thermal conditions.

In this project, Elevate conducted a community risk assessment by engaging a Chicago community in discussions on extreme heat. Elevate collaborated with UnBlocked Englewood<sup>5</sup>, an initiative led by the Chicago Bungalow Association (CBA) and social practice artist Tonika Lewis Johnson. UnBlocked Englewood utilizes a whole-block approach to provide whole-home retrofits to residents of a block in Englewood that has experienced historic disinvestment. Through community engagement and interviews with residents, this project focused on information gathering around heat adaptation strategies, risk assessment, cooling strategies, and other community-driven solutions. The interview questions and engagement efforts helped make connections

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<sup>1</sup> <https://www.weather.gov/hazstat/>

<sup>2</sup> Hayhoe, K., Sheridan, S., Kalkstein, L., & Greene, S. (2010). Climate Change, Heat Waves, and Mortality Projections for Chicago. *Journal of Great Lakes Research - J GREAT LAKES RES.* 36. <https://doi.org/10.1016/j.jglr.2009.12.009>

<sup>3</sup> [https://www.weather.gov/lot/2023\\_08\\_23-24\\_Heat#:~:text=Chicago%20officially%20observed%20a%20high%20t](https://www.weather.gov/lot/2023_08_23-24_Heat#:~:text=Chicago%20officially%20observed%20a%20high%20t)

<sup>4</sup> <https://www.nrel.gov/docs/fy22osti/83575.pdf>

<sup>5</sup> <https://www.chicagobungalow.org/unblocked>

between building envelope improvements (i.e., weatherization) and extreme heat resiliency. Additionally, Elevate coordinated a knowledge sharing session with NREL, Elevate, Illinois Tech, Pacific Northwest National Laboratory (PNNL), Oak Ridge National Laboratory (ORNL), and Lawrence Berkeley National Laboratory (LBNL) to learn from each other's research to better understand the relationship between air sealing, insulation, and thermal resiliency. This report includes an analysis of interview findings, informs messaging around extreme heat risk and adaptive strategies, including envelope improvements and weatherization, and provides recommendations for organizations in Chicago to guide extreme heat resilience and response efforts.

## Project Overview

In this project, Elevate assessed a community's perspectives related to extreme indoor heat after their home underwent energy efficiency retrofits, home repairs, and health and safety measures through UnBlocked Englewood. This report includes a descriptive analysis of the homes' building characteristics, neighborhood characteristics, interview findings, and solutions for mitigating and adapting to extreme heat.

### Problem Statement, Objectives, and Research Questions

As the climate warms, extreme indoor heat is becoming more of a concern, especially for those who lack access to adequate cooling systems in the home. People living in historically colder climates like Chicago face greater health risks from extreme heat in comparison to warmer state populations that are more acclimatized and prepared for warm weather.<sup>6</sup> As climate patterns shift, there is a need for investment in increased awareness, preparedness, and adaptation efforts in cold climate locations. We know that many households in Chicago may be under-prepared for effectively managing extreme heat, and Elevate has found that Chicago residences without central AC experience dangerous conditions during heat waves.<sup>7</sup> Therefore, there is an urgent need to better assess the risk from extreme heat in Chicago and better understand the most effective methods for managing indoor heat.

With the large influx of funding for clean energy investments, it is critical that policy makers and program implementers understand what types of homes are most vulnerable to extreme heat and what retrofit packages will be most successful in increasing thermal resilience without increasing energy burdens among those most vulnerable to the impacts of extreme heat.

To address the above Problem Statement, Elevate:

- Engaged a Chicago community to understand the community's perspective and perceptions of their risks related to extreme heat, adaptive capacity strategies, and cooling behaviors.
- Investigated the relationship between air sealing, insulation, and thermal resiliency to better understand building performance during extreme heat.
- Will develop messaging to inform community engagement and future deployment efforts around extreme heat risks and adaptive capacity strategies, as it relates to variation found among the five most common housing types in Chicago.

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<sup>6</sup> Howe, P. D., Marlon, J. R., Wang, X., & Leiserowitz, A. (2019). Public perceptions of the health risks of extreme heat across US states, counties, and neighborhoods. *Proceedings of the National Academy of Sciences of the United States of America*, 116(14), 6743–6748. <https://doi.org/10.1073/pnas.1813145116>

<sup>7</sup> <https://www.chicago.gov/coolchi>

To accomplish these objectives, this project sought supporting evidence for the following research questions:

- 1) How do residents perceive risks from extreme heat and what are their top concerns and challenges related to extreme indoor heat?
- 2) What strategies, resources, and assets are most beneficial for residents coping with persistent indoor heat and emergency heat events?
- 3) How do energy efficiency improvements impact indoor temperature and thermal comfort during extreme heat?
- 4) Can electrification programs be targeted to prioritize certain home types or characteristics to address thermal comfort and occupant safety?

## Approach

### ENGAGEMENT PLAN

Elevate partnered with the Chicago Bungalow Association and social justice artist Tonika Lewis Johnson to engage residents of UnBlocked Englewood. This engagement involved connecting with community members and learning about how extreme heat impacts their lives. The outcome of this engagement was the identification of solutions for preventing, mitigating and responding to heat within the home. Elevate's engagement efforts focused on understanding the community's perspectives on extreme heat, their methods of coping with heat, and determining resources and assets that would be most beneficial in managing extreme heat.

### DATA COLLECTION PLAN

Data was collected from 13 community members, who live in 10 buildings, and are participants of UnBlocked Englewood, a whole-block approach of retrofitting 24 buildings with a total of 75 residents. Data was collected through semi-structured interviews with the participants.

### RECRUITMENT

Elevate worked with the Chicago Bungalow Association and Tonika Lewis Johnson to recruit 13 participants for interviews. Interviews were conducted by Elevate in July 2024 and participants received stipends for their time.

### INTERVIEW DATA COLLECTION

Elevate developed interview questions (available in Appendix A) about extreme heat in an effort to better understand a community's ability to respond and adapt to risk as well as how residents who live in vulnerable situations change their behavior to cope with and manage extreme heat. Elevate designed an interview guide that assesses resident comfort, risk perception, resource utilization, and capacity to prevent and respond to extreme indoor heat. Elevate led the development of interview questions to gather information on heat and health decision-making, risk perception, and heat adaptation strategies. The Chicago Bungalow Association, Tonika Johnson, NREL, and DOE provided input on these and additional questions that can assess resident thermal comfort and building envelope upgrades. Elevate then conducted interviews with 13 Chicago residents who are participants of the UnBlocked initiative.

Interview focus areas:

- Decision-making around extreme heat within the home
  - Methods of responding to increasing temperatures
  - Heat and health motivations
  - Attitudes and beliefs related to extreme heat
- Experiences during extreme heat events

- Current practices for heat mitigation and adaptation (strategies and resources used)
- Challenges and issues experienced, concerns of adverse effects
  - Health and mood impacts from extreme heat
- Perception of risk, concern areas, and thermal comfort during extreme heat events and non-extreme summer days
- Impact of envelope improvements on perceived thermal comfort and risk and barriers to envelope improvements
- Ability to adapt and respond to increasingly frequent and long-lasting heat events
- Resources needed/requested, both long term and short term
- Community relationships and community cohesion

### KNOWLEDGE SHARING PLAN

Elevate coordinated a knowledge sharing session in October 2024 with NREL, PNNL, LBNL, ORNL, and Illinois Tech to discuss relevant research regarding heat, efficiency measures, and building characteristics. The purpose of this meeting was to share findings from this project and better understand the relationship between air sealing, insulation, and thermal resiliency by learning from each other’s research. This report includes recommendations and other takeaways from this session.

### ANALYSIS

Qualitative data from each of the 13 interviews was coded based on key themes. Similar responses were summed to represent the number of people who expressed that viewpoint or experience. Themes and counts of responses are presented in the findings alongside quotes from participants that depict the theme and provide additional context.

## Findings

### Participant, Building, and Neighborhood Characteristics

This section details the 13 participants’ demographic information and the characteristics of their home (e.g., construction type, cooling equipment). The 10 homes selected for this analysis are located on the same block, and all were part of UnBlocked Englewood, a whole-block approach to home energy efficiency and electrification.

#### NEIGHBORHOOD CHARACTERISTICS

Englewood is an environmental justice community<sup>8</sup> with a history of discriminatory housing practices, including land sale contracts.<sup>9</sup> The neighborhood’s residents are 95% Black or African American, a race that has been found to have increased vulnerability to heat-associated morbidity and mortality.<sup>10</sup> The neighborhood also has a high rate of poverty, falling in the 98th percentile for low income households and with 51% of individuals living

<sup>8</sup> Climate and Economic Justice Screening Tool: <https://screeningtool.geoplatform.gov/en/>

<sup>9</sup> Inequity for Sale, a project by Tonika Lewis Johnson: <https://inequityforsale.com/>

<sup>10</sup> Gronlund C. J. (2014). Racial and socioeconomic disparities in heat-related health effects and their mechanisms: a review. *Current epidemiology reports*, 1(3), 165–173. <https://doi.org/10.1007/s40471-014-0014-4>

below the poverty level.<sup>11</sup> These factors contribute to the neighborhood being considered highly vulnerable to heat risks.<sup>12</sup>

**BUILDINGS INCLUDED IN PROJECT**

The 13 interview participants in this project live in 10 homes that are detailed below. The participants included three couples who live in three homes (couples were interviewed separately) and the remaining seven participants live in the seven other homes; because we interviewed three couples, there are more participants than homes in this project. Through UnBlocked Englewood, each of these homes received repairs such as roof replacements, plumbing, ceiling repair and reframing, electrical panels, gutter replacement, drywall, porches, and more. Chicago Bungalow Association implements the Home Energy Savings Program in partnership with local gas and electric utilities<sup>13</sup>, and all homes received health and safety measures (e.g., carbon monoxide sensors) and all received air sealing and insulation. All work on the homes was completed by Fall 2023, and interviews were conducted in late July 2024. Therefore, participants had experienced a full winter after the upgrades and a few months of summer post-upgrades as well.

Of the five home types in Chicago<sup>14</sup>, these homes represent three of those housing types: single-family frame homes built pre-1942, single-family brick homes built pre-1942, and 2-4 unit brick homes built pre-1942 (Table 1). The vintages of these homes range from 1882 to 1927 with a median of 1902.

*Table 1. Housing type of each of the participating homes*

Housing Type	# of homes in study	Building prevalence in Chicago
Single-Family, Frame, Pre-1942	5	13.9%
Single-Family, Brick, Pre-1942	1	19.0%
2-4 unit, Brick, Pre-1942	4	10.0%

As shown in Table 1, these 10 homes represent a mix of frame and brick construction. Figure 1 and **Error! Reference source not found.** depict the frame homes and brick homes included in the project.



*Figure 1. Frame homes included in project*

<sup>11</sup> U.S. Census Bureau. "Poverty Status in the Past 12 Months." American Community Survey, ACS 5-Year Estimates Subject Tables, <https://data.census.gov/table?q=poverty>

<sup>12</sup> Disparities in Heat Vulnerability in the United States. Yale Center on Climate Change and Health.

<https://storymaps.arcgis.com/stories/887792e05ea744d3b085856ca061ef53>

<sup>13</sup> <https://www.chicagobungalow.org/programs>

<sup>14</sup> <https://www.nrel.gov/docs/fy22osti/83575.pdf>



Figure 2. Brick homes included in project

## **PARTICIPANTS**

Thirteen people were interviewed by Elevate for this project. All of the participants are Black or African American, 77% are senior citizens, 54% are women, and 46% are men. Most of the participants own their home (85%) while 15% rent their home. Their self-reported annual household income ranges from \$0 to \$58,000.

## **Heat Risk Perceptions and Concerns**

The section outlines participants' concerns regarding indoor heat and increasingly warmer weather. This section also reports on their perception of safety from heat, level of preparedness, and perspective of extreme heat vulnerability in their neighborhood.

### **INDOOR TEMPERATURE PERCEPTIONS AND THERMAL COMFORT**

When asked to estimate their home's indoor temperature during the summer, participants reported a range of 65°F to 80°F, for an average of 73°F. Participants were asked what summer indoor temperature they think is unsafe and they reported a range from 75°F to 95°F for an average of 84.6°F. Regarding indoor safety, participants expressed the following thoughts:

*[The hottest it's been in the house] is maybe 100? When I open the windows, that temperature gets hotter.*

*I can deal with the 80s. When it be in the 90s-95 like that, by me being a senior citizen, I really can't deal with that heat.*

*I don't turn it [the AC] on, so it gets up to like 90 or something like that.*

*If it's 90 degrees outside, it's 87 in here. That's really unsafe.*

*If your house go past 76, you're basically uncomfortable. 76 is the most you need.*

Participants were also asked about how satisfied they were their home's temperature during the summer and they reported high satisfaction (8), moderate satisfaction (2), and low satisfaction (1). As shown in Figure 3, participants reported a higher ability to keep the indoor temperature safe than keep it comfortable.



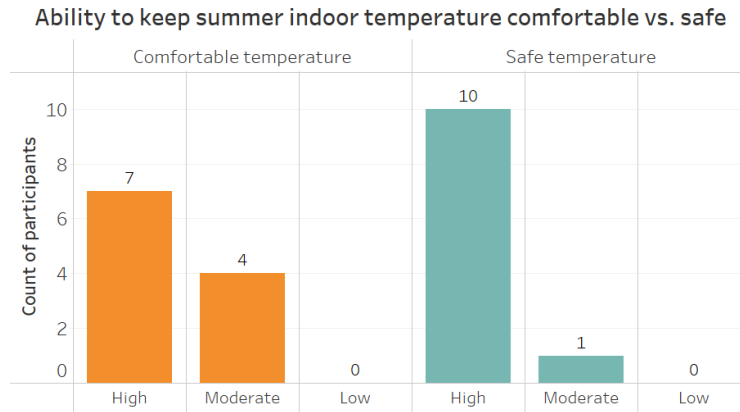


Figure 3. Participants' ability to keep summer indoor temperature comfortable vs. safe

### EXTREME HEAT CONCERNS

Participants expressed a variety of concerns related to extreme heat and increasingly warm weather, but many participants also said they don't have concerns like that after receiving the upgrades or had more of a "I just deal with it" approach rather than specific concerns. The table below shows the concerns expressed by participants, the count of the number of people who had the concern, and quotes from participants to elaborate on the concern.

#### Participants' Extreme Heat Concerns

Concern	# of People	Quote
None	5	<p><i>I just deal with it as it comes. I try to let nothing get next to me. I just deal with it.</i></p> <p><i>I just think it's the will of God. I accept what he give me.</i></p> <p><i>I just hope I stay cool when I need to be cool, and I stay warm when I need to be warm in the wintertime. The wintertime is the main thing. <b>The summer I can deal with that cause you can always get a fan or AC. But that wintertime--it's uncomfortable to live in cold. It's real hard to live in the cold. And when you take a bath it's freezing. [...] I could deal with being hot, I know how to stay cool. But in the wintertime it's hard to stay warm. It be real cold, you know how cold it get up here.</b></i></p> <p><i>Right now, I'm confident with what took place. I don't have them concerns like them no more.</i></p>
Cost of AC, using AC	4	<p><i>We'll keep it on a while in the morning. You know, close the curtains, try to keep all the heat out, and keep the house cool. And then maybe later on in the afternoon it gets up really high, then you can run it for a little while. <b>But we can't sleep with it on, we do that to keep the cost down.</b></i></p> <p><i>I'm kind of nervous about keeping things like that [the AC] running while I'm sleep. I'm really nervous about that.</i></p>
Respiratory problems	4	<p><i>The respiratory, the breathing, you know the moisture, we need more moisture in the house.</i></p>

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*I can't be out in the heat. Because I have COPD, I can't be out in the heat.*

*Breathing. I had heart surgery so every now and then, my breathing.*

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Concern for the elderly/neighbors	4	<i>When I see people and especially our elder people in these buildings--I know they're not safe. I know they're not.</i>
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Heat distribution within home	2	<i>Upstairs it gets hot and down here, it's just more comfortable. So my concern is getting down here. And I know you talking mainly with the heat but my whole concern is to get the job done that I'm trying to do. And that's get downstairs good. My wife, she can't be going up the stairs because she has the cane and trying to get down here...Other than that, I will be okay.</i>
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*Trying to get a balance. Throughout the house, one room might be warmer than another one and the cool air might be a lot cooler in another room.*

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Power outages	1	<i>When the lights went out of here, I was about to cry. Because everything shut down on me. I said "how we getting any air?"</i>
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Over-exertion	1	
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When asked, "Does anything prevent you from using your air conditioner?" seven people reported limiting AC use due to costs. For example, one person said, "Sometimes I get really hot and I'm like, "Man it's hot in here." We gotta open the windows or if it's breezy, we'll come out, and sit outside, but try not to, again, try not to run that bill up too high." Two people also mentioned limiting AC use because the air can be too cold; for example, one person said that the cold air may affect her husband's arthritis, so she turns the AC off for his comfort.

### EXTREME HEAT IMPACTS AND CHALLENGES

This section reports on the set of questions we asked about times when their home became too warm and how those experiences impacted them.

When asked, "Have you ever had past difficulties sleeping at night due to extreme heat or sweat a lot even though not doing any physical activity?" 83% of respondents (10 people) said yes while 17% (2 people) had not experienced these challenges. One person explained, "At night it was like I'm suffocating. Even with the little air I did have--because it was so stuffy. You go outside and you see the humidity is XYZ, well it was the same way in the house."

Participants reported several health impacts related to high indoor temperatures, with the top health impacts being difficulty breathing, shortness of breath, and worsened asthma symptoms.

#### Health Impacts from Extreme Heat

Impact	# of People	Quote
Difficulty breathing/shortness of breath/asthma worsens	6	<i>Going up and down the stairs[...] it's not good. It's not good when it's really, really hot. [...] Because to me, <b>when it gets really hot, it affects your breathing. And sometimes they tell seniors to stay in the house and don't go out in the heat. But it'd be hot in the house too.</b> So that that is something that it affects--the respiratory.</i>

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*[The heat] almost cuts off my breathing.*

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*When the temperature's real high, I have to be in some air so I could breathe good.*

Dryness (incl. nosebleeds from dryness)	2	<i>[I think] what can I do to be cool? Because if it gets too hot, my nose will bleed, because of the dryness.</i>
		<i>Yes, trouble sleeping and breathing. Your body temperature can become overheated and that's bad. Especially when you're like me, I have sinus and it's hard to breathe. You're blowing and you got dry throat and dry nose. It's no good if you get too much heat. You can't be comfortable like that.</i>
Blood pressure impacts	1	<i>[Last summer] I had five fans on because I had a pet, and I had to keep him cool. I was burning up in here because I take high blood pressure medicine.</i>
No health impacts	2	<i>The temperatures never really affect me. I mean because I have been living here for a while. So I kind of know how the heat is. So I've been dealing with it, but far as the heat affecting me, it really has never been a problem</i>

In addition to physical health impacts from extreme heat, participants also reported emotional and mental health impacts related to heat.

**Emotional and Mental Health Impacts from Extreme Heat**

Impact	# of People	Quote
Irritability and negative mood	5	<i>[I feel] miserable. Grouchy. You don't want to talk to anyone. Leave me alone, I'm hot.</i>
		<i>If I'm really hot then yes, I'm different. I'm evil, sick, I don't want to be bothered. But heat, you know the heat makes you miserable. And I don't like the heat. I was born in June, but I love the winter, the fall, but I do not like the summer. Period.</i>
Lack of motivation	2	<i>It makes me lazy, I don't have no get up, I'm not motivated.</i>
		<i>When it gets too hot, it mess with me. [I'm] miserable. I don't want to do nothing when it's hot.</i>
Worry	1	<i>I'd just wave it off or sit up under the air conditioner. Knowing I really couldn't afford the air conditioner, because it was so [expensive].</i>
None	3	<i>There are certain things you just have no control over. So I accept it what it is.</i>

Similarly, participants were asked which of their daily activities are impacted during high temperatures and cooking and baking were the most-reported response.

**Activities Impacted by Extreme Heat**

Activity	# of People	Quote
Cooking/baking	4	<i>The fact that I'm not motivated to cook. So that means we got to buy stuff that's already cooked, and we try not to eat out but you got to eat, you know...So I'm not motivated to do too much of anything. Which is more of an expense when you got to eat out. You got to look at all those things, too.</i>
Cleaning	3	<i>It's just too hot in here! No, I can't take this! No I'm not cooking! If I'm doing something and I'm cleaning a lot of dust, like sweeping some dust or some of the old walls, trying to tear em out, there's a lot of dust. That affects me cause I got asthma.</i>
Movement, general	3	<i>I try not to exert my energy. Try and limit whatever I do around the house, try to limit it so I don't exert myself. Just take my time.</i>
Work	2	<i>You get up, you got to go to work tired, you haven't had enough sleep. Then you got a couple of older people in here [...] and the heat was killing them too.</i>
Going outside, yard work	2	
Climbing stairs	1	
No impact	2	

**NEIGHBORHOOD VULNERABILITY AND SOCIAL COHESION**

Social cohesion represents an important buffer to neighborhood resilience during extreme heat events. We asked participants if they believed others in their neighborhood were vulnerable to heat and the majority (9 people) indicated yes. More specifically, many cited the older age of their neighbors as the main vulnerability point. They also reported a high level of social cohesion, with many (9 people) reporting that others check on them during extreme heat and even more (11 people) reported checking on others.

	Yes	No	No answer
Are others in your neighborhood vulnerable to extreme heat?	9	3	1
Does anyone check on you?	9	4	0
Do you check on anyone?	11	0	2

Resident expressed the following thoughts regarding vulnerability:

*It's good to check on everybody. Make sure everybody's ok if it's getting to the point where it's threatening. The heat is threatening, because it's **the older you get, the heat could get dangerous.***

*Mostly everybody around here, is over forty. May have a couple of millennials. But **with our age bracket, we're vulnerable to heat.***

*The older generation, older people like me, **they can't accept the real warm temperature like the younger people.***

*Yeah some people vulnerable, they don't got no AC or nothing. **A lot of people don't got nothing. They might got a fan but when it be real hot, fans don't work.** So yeah people are vulnerable.*

*There's no one on the block that I think is more or less a problem as far as the heat concern. Because I think most [...] are just like me. And they either got central air or they got an air conditioner. So they not going to be out in the heat. I don't even think we have anybody on the block that I would have to call and make sure that they okay. I would be concerned about the elderly people, if it's too hot, but I don't think we have nobody that we need to do that. **I think everybody on the block is kind of like me--when it's too hot, you find a place to keep cool.***

## Extreme Heat Preparation and Adaptation

In this section, we present findings from the homeowner interviews, specifically focused on the questions on extreme heat preparation (e.g., preventative measures) and response (e.g., adaptive behaviors and strategies).

### PREPAREDNESS

Participants reported a high level of preparedness for heat waves, with only two people saying they don't feel very prepared.

#### Extreme Heat Preparedness Level

Preparedness Level	# of People	Quote
Prepared	10	<i>I'd say high [preparedness]. We're on alert, we're ready because there's older people, so we do wellbeing checks every day, check everybody out everyday. Make sure everything's just perfect. If you don't see them in they room or outside, "are you ok man?", things like that.</i>  <i>Yes, I will have to. You got to survive it, get through it. You got to find the best way to stay cool.</i>  <i>I'm alright in here. I feel sorry for them out there</i>
Not prepared	2	<i>I don't [prepare]. I just wait and I do whatever to cool down. There's nothing you can prepare for I don't think.</i>
No response	1	.

When asked how they prepare when they know a heat wave is coming, participants reported the following preparations:

#### Extreme Heat Preparations

Manage activity times/locations	Limit activity/movement	3
	Stay in house	3
	Plan outdoor activities early in day	1
	Sit in finished basement	1
	Sit in shaded area	1
	Sit under fans	1
	Sit near AC	1
Manage use of appliances/hardware	Turn on/up AC	2
	Turn on fans	1
	Close windows and blinds	1

Food/water intake	Drink cool water	6
	Get ice	2
	Eat cool foods	1

## ADAPTATION

Participants also reported using various actions to keep cool during a heat wave, with the top action being turning on the AC. Participants were also asked if there are any resources they utilize when their home becomes too warm, but many of them stated they don't use any resources other than their AC at home.

### Actions to Improve Comfort during Heat Wave

Turn on AC	12
Turn on fan(s)	10
Drink water, eat cold food	6
Take a cool shower	5
Go outside/sit on porch	5
Close curtains/blinds	4
Limit movement/be still	4
Open windows	4
Close windows	3
Go to basement	3
Sit in car with AC	3
Turn off lights	2
Wear less/cooler clothing	1

Participants explained their heat adaptation strategies in the quotes below:

*I'll sit on the back porch if worst comes to worst. That's what I did when it was storming. I sat right on our back porch, til the power came back on.*

***We didn't have no electricity for almost like two days. So it was real, real hot. I mean hot. I couldn't turn the AC on, because we didn't have no electricity. So I go out and sit in my car for a while.***

*In the morning, especially when you know it's gonna be hot, we keep the curtains closed, and **everything closed to keep the sun from coming in, to keep the rooms cool.** And now, we open up the windows because the sun wasn't beaming in, so we get some of this nice breeze, rather than turning the AC on.*

*I close the windows, the blinds, the curtains. **As long as it's dark in the house it'll stay cool.** See, that's why it's dark down here, that's why we keep it dark and that's why it's so nice and cool.*

*When it's extremely hot and I can't sleep, I get up and walk outside. Certain parts of the house is cooler than others, like the basement. The basement is very comfortable. So **I'll go down in the basement and sit for a minute or on the back porch.***

Similar to previous findings, most participants (83%) did not report leaving the home as a strategy for coping with high indoor heat. Those who did leave the home went to either a car with AC or to a coffee shop, though all said this occurred rarely. Participants explained that they “didn't feel the need to leave” and “prefer to stay home.”

### Reasons for Staying Home in Extreme Heat

Reason	# of People	Quote
Don't need to/prefer to stay home	10	<i>I don't go to no cooling centers or nothing. I'll be alright, the system works, I be staying cool. I ain't gonna be sitting around hot.</i>  <i>No particular reason, I can go if I want to. If I had to go, I will go.</i>  <i>It don't get that hot. It's not that bad, thank God.</i>
Don't like crowds/dealing with other people	2	<i>We don't know anywhere to go. I don't want to go to the beach. Too many people.</i>  <i>[In the past] I had to go to a cooling center all day and read books. And it was noisy in there. Folks coughing and telling them to be quiet. No more.</i>

## Pre- and Post-Upgrades: Indoor Thermal Comfort and Related Impacts

This section explores participants' thermal comfort, both prior to any retrofit work being done (pre-weatherization work) and after the upgrades. All work on the homes was completed by Fall 2023, and interviews were conducted in late July 2024. Therefore, participants had experienced a full winter after the upgrades and a few months of summer post-upgrades as well.

Participants reported both cooler indoor temperatures during the summer and warmer indoor temperatures during the winter. Other changes noticed during the summer were a decreased need to use AC and fans as well as lower utility bills.

### Changes Post-Upgrades: Summer

Change	# of People	Quote
Cooler	9	<i>Before we got the insulation, the <b>heat was just overwhelming. The heat would just come in.</b> But the insulation helped out tremendously. The change has been, like I say, just the comfortability. Before the installation, if you guys had come before the installation, you would have been able to tell a big difference. <b>It's the temperature, it's beautiful. See, we not sweating now.</b></i>  <i>I had five fans running plus the air conditioner was on. That's what I had to do to keep cool here. Ain't have to do that this year.</i>  <i>[It used to be] maybe 80 but then like I said having the fans [would help]. But now with the with the upgrades it's more 65-70.</i>  <i>Right now everything is beautiful, right now everything is great. <b>There hasn't been an incident that it's too hot. It hasn't been an ambulance, hasn't been no heat strokes, and everything's perfect.</b> I had one guy [tenant], an older guy. He had asthma. And he moved in, it used to be brutal. He hid in the room like that and since Bungalow came he don't have that problem.</i>

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Use AC/fans less	5	<i>[The AC] works. I just don't cut it on. I don't need to. I was thinking it was going to be extremely hot like it was before you all did the insulation. Didn't even need it.</i>
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*After they did insulation, if I run the AC for a couple days then it might cool off outside and I could turn the AC off and it still would be cool in the house for a couple days. **I think the insulation helped with that cause it stay cool in the house. I don't have to have the AC on, it gets too cold then I'll turn it off for a couple days.***

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Lower utility bills	3	
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Slightly more people reported greater warmth during winter and seemed to notice the effects of the air sealing and insulation more during the winter. For example, one person noted, “Really, I’ve noticed that [change in comfort] more in the winter. We weren't getting all that cold air. So that means maybe the summer is not as hot.” Other changes noticed during the winter was that the home was less drafty and gas bills were lower.

**Changes Post-Upgrades: Winter**

Change	# of People	Quote
Warmer	10	<p><i>In the winter time, I was using the stove sometimes [...]That's dangerous, doing that. Carbon monoxide and all that. But in the wintertime for years that's--the stove was the main part to keep it warm. I ain't like doing that. So them <b>doing the insulation and the roof, that stopped me from having to turn the stove on. I don't do that no more.</b> [...] I watched it when it got cold to see was the roof and insulation going to help? And it helped, it did. It made it warmer.</i></p> <p style="text-align: center;"><i>I could cut my unit down to 65 and I was comfortable. Very comfortable, and I'm in a large house. It was just unbelievable. Amazing how what a difference insulation and caulking and sealing up is. <b>You'd be surprised how much air you're taking in and how much heat you're losing.</b></i></p>
Less drafty	3	<p><i>In the wintertime, <b>the wind doesn't come through the walls anymore. It used to come straight from [outside] into the bones.</b> [...] You gotta know how to prepare for the winter, for the cold that we had from 2008 until last year. But now I can put sweats on and a t-shirt and walk around.</i></p>
Lower gas bills	3	<p><i>I couldn't tell at first. But then when the winter came, I was turning the furnace on. The heat stayed better. My gas bill went down. That's how I knew, because <b>my gas bill used to be out the roof because the heat was just going out the old windows and out the roof. As I told you, there was holes where you could see the sky.</b> So once they fixed the roof, my gas bill went down some and I'm grateful for that because the gas bill was \$1,000 and all that.</i></p>

Overall, 100% of participants reported positive opinions of the upgrades overall and all experienced positive changes in their home, regardless of home type.



*I needed help. I wouldn't ask for it because I'm not the type to ask, I just do what I gotta do, but I needed help. And when they came in, oh my God. I could not believe it. **It was just like I woke up one morning and said "This gotta be a dream. Because it's unreal." But it happened.***

*I love the Bungalow Association. They are a blessing from God. **I feel like I hit the lottery getting that roof did [fixed]. I used to be stressing about it every day.** I'm in a job where I don't get paid enough to--I was trying to save but I couldn't save up to get it fixed. They came out of nowhere and I'm grateful.*

*I'm thankful for it [the upgrades] and **you don't realize how your home can affect your health. You think, "Oh, I'm in the house. I'm okay." But it can be a problem.** You know, you don't know it until you change over. You see, my basement was like moist, a lot of moisture in there. I had a little fan to pull it out. [Now] I don't even have to use it. I haven't even used it this year.*

*It was just too much before you all came. **Now that everything's all over, I see the difference. I said I wish y'all would have came way before then. [...] I didn't know the magnitude of how bad it was. It's beautiful now. [...]** The stripping helped so much. I didn't know what that was. We never had stripping. [In the past] One day I was sitting in there trying to eat in the chair. I thought I would freeze to death in there.*

*They answered all my prayers. They fixed the roof. You could see the sky through the roof, it was messed up like that. The wood was all messed up, ate up, it'd been raining so much. Over time, that long, it was damaged for years. So they fixed the ceilings, the fans. **They did a good job, they helped me a lot. So after they did that the temperature like stayed the same. [...] If I can get it cool, it'll stay cool, I can turn off the air for a little while. When it was cold outside, I turn the heat on, it stays warm.***

## Solutions to Build Heat Resilience

Participants were asked to address the challenges discussed above by sharing participants' suggestions for improving issues related to extreme heat. These findings include both short-term and long-term solutions for managing heat. The most-reported solution for managing extreme heat was central air conditioning.

### Short-term Solutions

Distribution of cold water, cold foods, easily prepared foods	4
Fans	2
Generator	1
Humidifier	1
Fuel for outdoor cooking	1

### Long-term Solutions

Central air	7
Window replacements	3
Weatherization, insulation	3
Electric bill assistance	2
More vents throughout house	1
Finish basement	1
Get house up to code	1
Community center (converted from existing space)	1

Outdoor seating	1
Front porch repairs	1
More shade	1
Wellness checks for elderly residents	1

Participants further expressed their ideas for solutions in the comments below:

*First of all, I need—it'd be much of a help if I could get central air. That would be the best thing that happened to me.*

*Central air. That would be huge. It would save my bones.*

***Try to get them an air conditioner and plug it up. Try to keep cool cause it be getting real hot in these buildings. People get sick, heat stroke and stuff. It be hot in these old buildings. Some people really don't got AC so they come and sit on they porch. That be how they cool off cause it be too hot in the house. A lot of these old people just come and sit on they porch cause they be hot, they don't got central air or nothing.***

***I would love to have central air. I would love to get my front porch and I would love to buy the lot next door. I would love to put out there in the back some tables and stuff and sit, and just I would love to do a lot of things. But like I say it's my first home and we're all trying to get some things intact now.***

*Well, my husband likes to sit back there on that patio, but it'd be hot. If he had a covering, something that provides shade. [It would be good] if we could have something like that in the back.*

In addition to the solutions shared by residents, one takeaway from the knowledge sharing session with NREL, DOE, PNNL, LBNL, ORNL, and Illinois Tech was the importance of having air conditioning when providing efficiency measures like air sealing and insulation. Without air conditioning, these measures may unintentionally cause increased heat retention in the home during the summer. Because of this, air conditioning is needed to ensure heat can be removed from the home.

## Discussion and Recommendations

Here, we will synthesize the findings from the community risk assessment of 10 homes and 13 individuals, with the goal of organizing our discussion around our objectives and research questions detailed above. This section will inform future community engagement and implementation efforts around extreme heat risks and heat adaptation strategies, and we will comment on how the study results can be used to benefit Chicago communities. Additionally, we will assess if there are any recommendations based on potential variation found among the five most common housing types in Chicago. It is important to note that the small sample size in this project limits the generalizability of conclusions regarding comparisons between home types. However, the case study approach we've taken here provides valuable insights, especially in pointing to areas for future program delivery and research.

The findings from these interviews with a community in Englewood indicate that their top concerns and challenges related to extreme indoor heat are the cost of using their AC, respiratory issues, and concerns for their neighbors and others. Interestingly, when asked “What are your main concerns as temperatures increase and heatwaves become more frequent?” the most common response was no concerns at all. This low level of concern could be contextualized by several participants having an attitude of “I just have to deal with it” and feel

that this issue is out of their control. Others also mention not having concerns about extreme heat since the upgrades substantially improved their thermal comfort. However, many participants (83%) did consider others in their neighborhood vulnerable to heat. This discrepancy between perceptions of risk and concerns for self vs. others could benefit from further exploration through community engagement to better understand the dynamics and intricacies of risk perceptions. *(Research Question 1: How do residents perceive risks from extreme heat and what are their top concerns and challenges related to extreme indoor heat?)*

One of the key findings from this project is the abundantly positive changes the participants have experienced as a result of the home upgrades they received through UnBlocked. Regardless of their home type, participants noticed distinct improvements in their thermal comfort during both summer and winter. Though only three of the five common housing types in Chicago were represented in this project, this qualitative data provides evidence of air sealing and insulation improving the comfort of the home. Many participants mentioned that their home does not reach as high of temperatures as it did prior to the upgrades and the home remains cooler for longer periods of time. *(Research Question 3: How do energy efficiency improvements impact indoor temperature and thermal comfort during extreme heat?)*

Similarly, participants mentioned efficiency measures like they received as one of the avenues for dealing with extreme heat, saying that others in the area also need air sealing and insulation. Central air conditioning was the most common response for what would be most beneficial for coping with persistent indoor heat and emergency heat events. Several home improvements were mentioned, such as window replacements and more vents throughout the house. Electric bill assistance was also recommended by participants so that they could use their AC when needed rather than limiting their AC usage due to concerns about the electric bill being high. As one person said, "I don't turn it [the AC] on, so it gets up to like 90 or something like that," and others also mentioned limiting AC usage due to cost concerns.

In response to what would be helpful for a heat wave happening in the near future (e.g., next week), some participants said a distribution of cold water, cold foods, and easily prepared foods would be helpful. Several participants reported cooking as the top activity impacted by extreme heat, and they avoid cooking due to the heat increase in the home and lack of motivation to cook. However, buying prepared meals is an expense that "adds up." Thus, a distribution of easily prepared meals was suggested. Among the least popular solutions was increased tree canopy, with many participants opposing increased tree cover despite the shade they provide. People said that trees "are a problem for homeowners," "do more harm than good," attract bugs and other pests, and that there is inadequate tree maintenance which results in trees damaging the home and other property like vehicles.<sup>15</sup> *(Research Question 2: What strategies, resources, and assets are most beneficial for residents coping with persistent indoor heat and emergency heat events?)*

Given the concern identified about air sealing and insulation exacerbating heat risk in homes without AC, and the participants response to increased thermal comfort resulting from the air sealing and insulation, electrification programs (assuming that they first address air sealing and insulation) could target homes without AC. Or, put another way, electrification programs could essentially trail efficiency programs to ensure that homes that are receiving air sealing and insulation are also then receiving AC via heat pumps.<sup>16</sup> *(Research Question 4: Can electrification programs be targeted to prioritize certain home types or characteristics to address thermal comfort and occupant safety?)*

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<sup>15</sup> During the week prior to these interviews, a storm caused damaged to homes in the neighborhood, including damage from trees.

<sup>16</sup> For example, Elevate and CBA coordinate and/or partner on their programs' delivery. CBA supplies a pipeline for Elevate's Building Electrification Programs in Northern Illinois.

# Conclusions

This effort to engage a Chicago community and learn about their perspectives on extreme heat provided valuable insights, especially in guiding future program delivery, policy, and research.

## RECOMMENDATIONS

- Fund solutions and resources requested by community members to improve their community's ability to mitigate and respond to both chronic and acute extreme heat while also providing community co-benefits.
- Provide access to safe and affordable cooling conditions to all who need it.
- In the Chicago area and places with similar climates, air conditioning should accompany air sealing and insulation in order to avoid causing indoor heat retention during the summer.
- Investigate the relationship between risk perception and indoor temperature safety thresholds for oneself as an individual vs. risk perception and safety thresholds for other groups like elderly, pets, friends, children, etc.
- Promote policies and programs that provide electric bill assistance for cooling during the summer so that people do not have to overly restrict their AC usage due to cost constraints. One approach for this recommendation is to expand LIHEAP cooling benefits in Illinois. This effort could also include promoting and designing other policies, such as low-income rates and electrification rates for households who are cooling insecure to help offset cost increases from adding or utilizing AC.
- Electrification programs that install heat pumps should prioritize households that lack central AC, especially in climates like Chicago where central AC access is low but is becoming increasingly important as summer temperatures increase. Relatedly, Technical Resource Manuals should appropriately value the addition of cooling as a co-benefit in electrification programs, and they must include an adder to baselines in Total Resource Cost (TRC) tests when central cooling is absent.

# Appendix A: Interview Guide

## Interview Guide

Name of interviewee: \_\_\_\_\_

Address: \_\_\_\_\_

Date: \_\_\_\_\_

### INTRODUCTION

*Thank you for agreeing to participate in this interview. We are interviewing you to better understand your perspective around extreme indoor heat and energy efficiency improvements. We want to learn more about different challenges people face with extreme heat and resources that would be useful for you and your household. We are also interested in your experience after receiving the upgrades from UnBlocked and how your home and your comfort might have changed. So for some of these questions, we may ask you to think back before those changes were made and compare to how things are now.*

*There are no right or wrong answers to any of our questions, we are interested in your own experiences. The interview should take approximately one hour, and you are free to skip questions or leave at any time. Our plan is to use what we learn from these interviews in a summary report and other materials related to the report, like presentations. We will not include your name in the report but will include quotes from you. Is that alright?*

*We'd like to take an audio-only recording of this conversation that will be used for informational and educational purposes. We'll keep it confidential, and we won't use your name. Is it okay if we record the interview?*

*Do you have any questions before we begin?*

### PERCEPTIONS AND THERMAL COMFORT

*We'll start off with some questions about your thoughts on extreme heat and the temperatures inside your home.*

1. To begin, can you tell me about the issue of extreme heat? Please share anything that comes to mind.
2. Now thinking of your home, what types of cooling equipment do you use to keep cool?
  - a. *<If responded with using AC>* Does anything prevent you from using your air conditioner? If so, what?
3. Thinking about this summer, how would you describe the typical temperatures inside your home?
  - a. Probe: How satisfied have you been with the temperature in your home during this summer?
  - b. Probe: Have you noticed any changes in your home's summer temperatures since getting the home upgrades from UnBlocked?
4. How capable do you feel to maintain a comfortable temperature in your home 100% of the time?

- a. Probe: What would make you feel more capable or equipped to maintain a comfortable temperature all the time?
- 5. What about unsafe temperatures, do you feel that you're able to keep your home at a safe temperature all summer?
  - a. Probe: What indoor temperature do you think is unsafe?

### **CONCERNS, CHALLENGES, AND EXPERIENCES**

*This next set of questions are about times when your home was warm and how those situations impact you.*

- 6. In the past, have there been times in your home where you had trouble sleeping because of the heat or you sweat a lot even if you were not doing any physical activity?
  - a. Probe: Can you say more about those times?
  - b. Probe: How often do you experience this?
- 7. How do high temperatures inside your home affect you?
  - a. Probe: Which of your daily activities are most impacted by extreme heat?
  - b. Probe: What challenges have you faced in the past when the indoor temperature is hot?
- 8. When your home becomes uncomfortably warm, what goes through your mind?
  - a. Probe: How has indoor heat impacted your health?
  - b. Probe: How has indoor heat impacted your emotional wellbeing?
- 9. What are your main concerns as temperatures increase and heatwaves become more frequent?
  - a. Probe: Can you say more about your top concerns?

### **PREVENTION, PREPARATION, AND RESPONSE**

*Now we'll talk more about heat within the home and what you do to keep cool.*

- 10. Since you've had the home upgrades from UnBlocked, have you noticed any differences in your home's temperature during the summer?
  - a. Probe: Can you say more or give an example of the changes you've noticed?
  - b. Probe: Are there specific areas of your home where you notice these changes more or less?
  - c. Were the upgrades on your home done prior to this past winter? If so, did you notice any changes in your home's temperature during the winter?
- 11. Overall, how do you feel about the upgrades from UnBlocked and their impact on your home?
- 12. Aside from the work that was done to your home as part of UnBlocked, have you made any additional changes to your home to prevent indoor heat during the summer/improve your comfort in terms of temperature?
  - a. Probe: What changes have you noticed in your home's temperature?
- 13. If you know a heatwave is coming, how do you prepare?
  - a. Probe: How would you rate your level of preparedness for extended periods of extreme heat?

14. When your home's inside temperature becomes very warm, what actions do you take to feel more comfortable?
  - a. Probe: How frequently do you take each of these actions?
  - b. Probe: During what part(s) of the day do you take each of these steps?
15. Are there any resources you utilize when your home becomes too warm? If so, what are they?
16. Are there any places you go to cool down when your home becomes too warm?
  - a. <If yes> Where do you go?
  - b. <If no> What prevents you from going to these cooler destinations?

### **COMMUNITY RELATIONSHIPS, COHESION, AND SUPPORT NETWORK**

*We're nearing our last set of questions and will now ask some questions about your community and support network.*

17. Do you consider people in your neighborhood vulnerable to heat?
18. When the weather is very hot, is there a neighbor or family member that you check on?
  - a. Is there a neighbor or family member you would feel comfortable asking for help?
19. When the weather is very hot, do any of your family members, friends, or neighbors who don't live in your home check on you?

### **RESOURCES NEEDED**

*Our last few questions are about what would be helpful for dealing with high temperatures in your home.*

20. Is there anything that would be helpful for addressing the issues and concerns you shared today?
  - a. What would be helpful for a heat wave that's happening next week?

*\*Interviewer note: if they do not mention any ideas, ask about cooling centers, air conditioners, items that would be helpful during heat wave, etc.*
  - b. Thinking more long-term, what would be helpful for a heat wave that's happening a year or two years from now?

*\*Interviewer note: if they do not mention any ideas, ask about additional home upgrades, increased tree canopy/shading, etc.*

### **CONCLUDING DISCUSSION AND NEXT STEPS**

*Thank you so much for speaking with us today. Your opinions and feedback are valuable and helpful as we work to advocate for additional resources to address extreme heat.*

- Any last comments or thoughts before you go?

**THANK AND DISMISS PARTICIPANT**